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Barriers to agricultural products diversification: An empirical analysis from lotus farming in Central Vietnam

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Abstract. Poverty alleviation, employment creation, environmental conservation and income augmentation can be transformed based on agricultural diversification. Lotus farming is considered as a solution to improve income and livelihood for smallholder farmers. Many different products and values can be explored from lotus farming including lotus flower, lotus root, lotus seed, lotus fiber, as well as combining ecotourism. But many barriers are preventing the lotus products diversification of lotus growers. This study will provide a better understanding of lotus farming and explore the barriers to lotus products diversification and causes of these barriers. Phong Dien district, central Vietnam was selected as a case study. The qualitative research was applied through 54 semi-structured interviews including lotus growers, lotus buyers and officers of local government, as well as one focus-group discussion, observation method and secondary data from statistical data and reports were also conducted. The research findings indicated that there is a big gap between lotus products diversification of lotus growers and available lotus products on the market. Lotus growers only grow and sell raw products, of which, fresh unshelled lotus seed is the main product. Lack of knowledge, worries on loss, lack of market and market information, lack of labour and machines and traditional production habits are main determinants of the barriers. Characteristics of lotus seed, high production and monopoly of collectors are different features in barriers to lotus product diversification compared to other crop diversification.
Key words: barriers, diversification, lotus grower, lotus farming, Vietnam.

Introduction

Diversification is defined as *"change in product (or enterprise) choice and input use decisions based on market forces and the principles of profit maximization"*(Barghouti *et al.,* 2004, 1). Diversification is considered as a business away through existing markets and products which can be a form of development (Joshi Gulati & Cummings, 2007). Market forces and profit maximization are two key principles to make a decision on diversification (Pingali & Rosegrant, 1995). In fact, declining or inadequate incomes, creating additional employment, available resources and skills, exploration economies of scale and scope, related or complementary products, agronomic and ecological requirements, willingness to enter new markets, reducing risk, response to new policies, business opportunities, and/or international assistance are causes of farm diversification that can be based on agriculture (crops, livestock) or non-agriculture (processing, transportation) (Bachev & Tanic, 2011, 3).

Market integration, employment, income expansion and sustainable rural development resulted from farm diversification (Bachev & Tanic, 2011). Moreover, in the context of uncertainties surrounding traditional farming practices, food price volatilities, global economic and financial crisis, and climate change, diversification plays a key role in income generating and risk reduction strategy, as well as ensuring food security and stabilizing food production (Bachev & Tanic, 2011; Waha *et al.,* 2018). Diversification can contribute to improving the competitiveness of smallholders at locality (Bachev & Tanic, 2011). In line with this, income is also increased based on crop diversification when production risks decrease and production activity becomes stable (Makate *et al.,* 2016). Importantly, "*households with higher farming diversity tend to be more successful in meeting their*

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consumption needs than households with lower diversity" (Waha *et al.,* 2018, 3394); and sustainable development goals can be achieved through agricultural diversification (Tamburini *et al.,* 2020).

Crop and agricultural products diversification are not new issues, it can be viewed as making increased variety of agricultural commodities, but the strong development of market-led commercial agriculture drags on the greater importance of agricultural diversification (Rao *et al.,* 2007; Satyasai & Viswanathan, 1996, 674). In which, diversification of food production has tended to increase in current years, especially in crops and cropping systems (Hertel *et al.,* 2021). In agricultural production, the attentation has been drawn to smallholder farmers in developing countries (Ellis, 2000). Lack of access to credit, agricultural inputs and output markets are still major issues to smallholder farmers due to poor economic status, as well as high transportation and marketing cost (Birthal, Roy, & Negi, 2015). Many researches have cited the important role of diversification in dealing with the issues of smallholder farmers. However, diversification is still facing various barriers. The research of Ellis (2000) indicated that seasonality, risk, labour markets, credit markets, asset strategies and coping behaviour are six main determinants of diversification in rural areas. Joshi, Gulati, & Cummings (2007, 231) indicated that infrastructure (markets and roads), technology (relative profitability and risk in different commodities), resource endowments (water and labour), and socio-economic variables (pressure on land and literacy rate) are the factors affecting to the diversification; meanwhile, Bigsten & Tengstam (2011) showed that determinants of diversification are driven by household income, market access and finance. The complex, interconnected and occur at multiple levels are typical characteristics of barriers to crop diversification (Brannan, 2021; Meynard *et al.,* 2017). To clearly explain diversification barriers in the agricultural sector, Morel *et al.* (2020, 9) specified barriers to crop diversification through 25 case studies, which contributes to providing meaningful information to better understand the barriers. Notably, the barriers were divided into input-output structure including agricultural production (lack of knowledge, lack of information, cultural barriers…), from harvest to retail (equipment for processing, low volume, high costs…), market (unstable market, awareness of consumers…) and coordination between value chain actors (limited cooperation, unbalanced power in bargaining, lack of communication…).

Crop and agricultural products diversification have happened in many countries and Vietnam is one of them. Importantly, lotus *(Nelumbo Nucifera)* plant is the national flower of Vietnam and a symbolism of Vietnamese women. It has grown from North to South of Vietnam. The total lotus farming area of Vietnam is about 3,000 ha. Lotus farming has one or two seasons per year, which depends the weather and topography of each region. The time of each season is from three to four months and the yield of lotus farming is about four tons per ha. As a result, lotus farming is developed as a new livelihood activity in many rural areas (Nguyen *et al*., 2022). Thua Thien Hue province, central Vietnam is a famous locality with Hue's lotus brand. Lotus farming is viewed as a solution to improve income for farmers. Lotus farming is easy to implement since it has high resistance and adapts to various arable lands. Moreover, lotus farming can explore various values from lotus flower, lotus root, lotus seed, lotus fiber, as well as combining ecotourism. Studies indicated that it can provide 2-3 times higher income than rice farming (Tien & Thong, 2014; Trang *et al.,* 2018). Moreover, Hue's lotus brand has created a competitive advantage for lotus products of locality (Van Chung *et al.*, 2023). Therefore, lotus farming has been concentrated to develop in recent years in Thua Thien Hue province, typically in Phong Dien district (Trang *et al.,* 2018).

Although Hue's lotus was regarded to be of high quality and was consumed in domestic and export markets, the development of lotus farming is inconsistence with its potential. Lotus growers only concentrated on producing and selling of fresh lotus seed, yet flowers, roots and leaves seem to be neglected (Tien & Thong, 2014). Lotus products diversification will provide different lotus products with various values that can contribute to improving income and livelihood for lotus growers. Because lotus products will be added value and expanded target customers and output markets (Nguyen *et al*., 2022). However, barriers to lotus products diversification seem to be existing and preventing the diversification of lotus growers. Notably, there is no research yet to explore and analyze this issue. Many scholars have explored the barriers to crop diversification, but presence or absence of these barriers is dependent on the plant team or specific crop, type of cropping system, geographic region, institutional environment, and the farmers. As a result, a specific crop or plant needs to deal with barriers in a case by case in the specific context of a farm (Brannan, 2021, 34). This study provides a better understanding of lotus farming and explores the barriers to lotus products diversification as a specific crop diversification. The study was conducted in Phong Dien district, Thua Thien Hue province, central Vietnam. The study focused on describing and analysing lotus production, lotus products diversification potential and barriers to lotus products diversification. From these points, the

suggestions and recommendations were established to support local government and lotus growers, which contribute to improving livelihood of lotus growers in particular and socioeconomic development of locality in general.

Materials and Methods

Study area

Phong Dien district, Thua Thien Hue province, central Vietnam was selected as a case study. The natural land area of the district is 953.751 square kilometers and the population is 104,583 people. The district also has suitable natural conditions and climate to develop lotus farming; and the local government verifies that lotus farming is one of the crucial economic sectors to promote socio-economic development at locality. As a result, lotus farming has been concerned by the local government and local people as well. Therefore, lotus farming has strong development in Phong Dien district and the lotus farming area is highest compared with other districts of Thua Thien Hue province. Moreover, lotus farming area and the number of lotus growers tend to increase in the near future, which responds to the development plan of local government.

Data and method

The qualitative research was applied in this study due to research problems will be explored, explained and analyzed concretely based on qualitative research (Chenail, 2011). Semi-structured interview was used to collect primary information from 54 respondents, who are lotus growers, traders, key informants and officers of local government. The criteria have been used to select the interview partners including: they are directly participating in lotus farming; they are direct buyers of lotus products at research site; they are managers and have rich experience in lotus farming at locality. The research focused on collecting information about characteristics of lotus farming, lotus products diversification potential of lotus growers, the barriers to lotus products diversification, as well as accessibility to market of lotus growers. The research used snowball approach to choose interview partners because the next respondents will be verified by information of previous interview partners (Noy, 2008).

Specifically, the interview process starts from a lotus grower, and then, this lotus grower will introduce next lotus growers, who will be selected to interview through criteria such as: lotus growers have rich or poor experience in lotus farming, large or small lotus farming area, high or low number of labors, successful or unsuccessful in lotus farming. The feature diversity of lotus growers contributed to providing various aspects or stories in the research problem. Based on the information of lotus growers, who are their buyers and who directly manages lotus farming activity that are also identified to make interviews. The interview process often took from one to one and a half hours. All interviews were recorded and transcribed by word that is used for data processing. The number of interviewees is based on the amount of obtained information that satisfies the research objectives and the repeatability of information (Koerber & McMichael, 2008).

Moreover, one focus-group discussion was organized to find out the reasons for diversification barriers and solutions of local lotus growers. The focus-group discussion had the participation of eight smallholder farmers including four males and four females, who are participating in lotus farming. They are invited from the list of lotus growers at the research site. The focus-group discussion process was conducted from introducing the main aim and main contents of the discussion to giving questions and promoting the discussion among participants. All results of the discussion would be determined by the unification among all participants to identify the research findings. The focus-group discussion is also used for checking information from the interviews, which contributes to ensuring the accuracy and the validity of research findings. Observation method was also applied to verify lotus farming of smallholder farmers and availability of lotus products. Secondary information was collected from reports and statistical data of local government, which relates to the status of lotus farming, development planning of lotus farming, advantages and disadvantages in lotus farming at the research site.

Results

Lotus production in Phong Dien district

Lotus farming started in Phong Dien district nine years ago. Lotus plant is grown in monoculture area or wetlands. Lotus farming areas of smallholder farmers are mostly used from lakes, ponds and converting from rice farming areas or renting land from other localities. This activity is mainly spontaneous by smallholder farmers. They have gained lotus planting technology from other local people. Hence, lotus farming has become freedom that is depended smallholder farmers' experience. Lotus farming has one season per year from January to April (lunar calendar), in which lotus farming in lakes often has longer cultivation than other areas. Lotus growers cannot increase the number of seasons per year because Phong Dien district is lowland terrain, which is easily impacted by floods in the rainy season.

Lotus farming is playing an important role in the livelihood of lotus growers and local socioeconomic development. Due to, the benefits of lotus farming

are verified by taking advantage of water surface, plant structure transformation, creating a landscape and high economic effectiveness. Many farmers have viewed lotus farming as their main income source.

"In the beginning, my family growed lotus to create a landscape, but it brought high income for my family compared to rice farming and I saw many other people in my village, who have had many changes in their life because of lotus farming. As a result, we decided to focus on developing the lotus economy" A smallholder farmer in Phong Binh commune.

The importance and values of lotus farming have created the changes in lotus farming area in Phong Dien district. The lotus farming area has increased significantly for 5 years, from 158 ha in 2016 to 355 ha in 2020. In recent years, the lotus farming area has had a slow increase due to the limited area of smallholder farmers and the local government has not had a specific plan to expand the lotus farming area (Phong Dien District, 2020). The lotus growers interview results indicated that the lotus farming area of each smallholder farmer is different, which fluctuates from 500 square meters to 30,000 square meter. About 95% of farmers are willing to expand the lotus farming area because of its economic efficiency.

Notably, lotus farming is evaluated that the production cost is low, about US$ 53.3 per 500 square meters. Of which, the cost of lotus seed takes the highest cost (70%) in the cost structure of lotus farming and the rest, such as fertilizer, labour working day is insignificant. However, it can provide high income for lotus growers in one season, about US$ 215 per 500 square meters. This leads to a significant increase of lotus farming area, as well as the number of participants.

"Lotus farming brought high income for farmers. Normally, lotus seed is sold from US$ 1.07 to US$ 1.29/kg, this price is 5 times higher than one kilogram of rice. Meanwhile, rice farming requires more labour working days than lotus farming. Rather, lotus farming can use family labour or leisure time to enhance income for the family. Old and young people also participate in lotus farming" A farmer in Phong Hien commune.

Potential for lotus products diversification

One of the most typical characteristics of lotus farming is to use various parts of lotus plant (lotus flower, lotus seed, lotus root, lotus fiber, lotus leaf, lotus sprouts), which can create various lotus products. In fact, many lotus products are available on the market, which are produced by various actors such as processors, enterprises or farmers. Each actor can create the different lotus products that depend on the function and ability of each actor. Hence, diversification of lotus

Table 1

Lotus products diversification ability of lotus growers

No.	Item	Available lotus products on the market (including processed products)	Lotus products of lotus growers at Phong Dien district	The rate of implementers (%)
1	Lotus seed	Fresh shelled lotus seed	Fresh shelled lotus seed	9.52
		Dry shelled lotus seed	Fresh unshelled lotus seed	100
		Lotus milk	-	-
		Lotus wine	-	-
		Lotus powder	-	-
2	Lotus flower	Fresh lotus flower	Fresh lotus flower	7.14
		Lotus flower tea		
3	Lotus leaf	Fresh lotus leaf	Fresh lotus leaf	4.76
		Lotus leaf using for handicrafts	-	-
4	Lotus sprouts	Lotus sprouts tea	Dry lotus sprouts	2.38
5	Lotus root	Pickling products	-	-
		Snack products	-	-
6	Lotus fiber	Fabric	-	-
7	Lotus farming area	Ecotourism (sighseeing, taking picture)	-	-

Source: Hong et al., 2009; Thuong et al., 2021; Tien & Thong, 2014, stakeholders' interview and observation

products is considered as an opportunity to add value for the lotus products and promote income sources for lotus growers as well. However, the lotus products diversification at Phong Dien district is still limitation.

Various parts of the lotus plant can produce many different products with different values, which can promote income for lotus growers. But, focus-group discussion and lotus growers interview indicated that lotus growers only grow and sell raw products, of which, fresh unshelled lotus seed is the main product that makes up a high quantity in the total all parts of lotus plant selling to buyers. 100% of lotus growers sell fresh unshelled lotus seed. Meanwhile, the number of lotus growers sell fresh shelled lotus seed, fresh lotus flower, fresh lotus leaf, dry lotus sprouts that only reach a low rate at 9.52%, 7.14%, 4.76% and 2.38% respectively. Even some farmers seem to not concern on selling other lotus products.

The research result showed that there is a big gap between lotus products diversification of lotus growers and available lotus products on the market. The diversification ability is mainly dependent on advanced technology application to produce value lotus products such as lotus flower tea, lotus milk, lotus wine and ecotourism. These products need actors, who have high investment in capitals and technology such as enterprises. Other lotus products such as fresh shelled lotus seed, dry shelled lotus seed, fresh lotus flower, fresh lotus leaf, dry lotus sprouts totally do not need high cost and technology, but they are not popular at smallholder farmers level. Importantly, fresh shelled lotus seed and dry shelled lotus seed can sell at a higher price than fresh unshelled lotus seed, yet fresh unshelled lotus seed is still a main product that is applied by all lotus growers.

Information from lotus growers and traders shows that lotus growers can sell fresh unshelled lotus seed from US$ 1.08 – US$ 2.15/kg, but the price of fresh shelled lotus seed is US$ 4.3 – US$ 6.03/kg (after peeling, two kilogram of fresh unshelled lotus seed will be one kilogram of fresh shelled lotus seed). Rather, lotus sprouts can be collected during the lotus seed peeling process and sold at US$ 12.9/kg (100 kg of fresh shelled lotus seed will provide one kilogram of dry lotus sprouts). In line with this, fresh lotus flower and fresh lotus leaf are also sold at US$ 0.13/flower and US$ 0.04/leaf respectively. On the other hand, fresh/dry lotus seed, dry lotus sprouts can increase storage time and value-added, as well as changing business mindset and income of lotus growers. But, lotus products diversification at smallholder farmers level is still facing many barriers, which will be analyzed section below.

Barriers to lotus products diversification

The benefits from lotus products diversification are clearly understood by farmers through the difference in price between raw products and processed products. Research result showed that 100% lotus growers are willing to improve income sources from lotus products diversification. But, local government, key informants, traders and lotus growers confirmed that there are many various barriers that are preventing lotus products diversification of lotus growers as follows:

Characteristic of lotus plant, especially lotus seed: Lotus growers need to harvest lotus seed when it comes to the harvesting time. Because, lotus seed becomes old and are not easily peeling, if farmers collect late. Thus, the price will be low and buyers do not give priority for buying or output market will be difficult. Moreover, after harvesting lotus seed, if lotus growers do not peel lotus seed to produce fresh shelled lotus seed, they have to sell all of them; due to the quality of lotus seed there will be reduction, if lotus growers do not have preservation systems.

Labour: lack of labour is a general situation of lotus growers. The average number of labour per lotus farming household is 2.4 labours and main labours are often old people, who range from 45 to 73 years old, young labour is not popular; meanwhile hiring labours is still facing difficulties in rural areas. Lotus products diversification needs to have labour to undertake harvesting and processing (peeling lotus seed). These works spend a lot of time and labour working day. Specifically, after harvesting lotus seed, if lotus growers want to produce other lotus products as fresh shelled lotus seed or dry shelled lotus seed, they have to cost time and labour working day to peel lotus seed and lotus sprouts (lotus seed shell and lotus sprouts also can produce lotus tea). On the other hand, harvesting lotus flowers or lotus leaf also needs labour, but lack of labour is a big barrier to diversification.

Machine and technology: lack of shelling machines is also a barrier to diversification. Especially at smallholder farmers level, nobody has or uses this machine for processing lotus products. Because, the cost is high and the effectiveness of the machine is not high, and the machines are not popular on the market. In which, peeling lotus seed is an important phase to diversify lotus products, but the availability, usefulness and accessibility of this machine are still problems of lotus growers.

"Fresh shelled lotus seed has higher price than fresh unshelled lotus seed, but lotus growers only provide small amount for market due to they lack labour and do not have machine for processing" Vice chairman of Phong Binh commune

Production scale: farmers, who have large-scale lotus farming (over 1,000 square meters), often diversify lotus products harder than farmers who have small-scale lotus farming. Due to, large-scale

farming often provides high production of lotus seed while the high amount of lotus seed needs to be processed in one day to ensure the quality and price. However, lotus growers do not have enough labour and machinery for processing. On the other hand, with small-scale lotus farming (500 – 1000 square meters), the harvesting amount in one day is small. Therefore, lotus growers can use family labors to produce fresh shelled lotus seed and use lotus sprouts. From this perspective, small-scale farmers can conduct lotus products diversification and achieve higher economic efficiency than large-scale farmers (the efficiency is only calculated for the same area unit).

Market information: Lotus growers illustrated that lack of market information is another reason for the barrier to diversification when they do not know who can buy other products except fresh unshelled lotus seed. However, there are some lotus growers who can sell lotus flower and lotus leaf, because they positively find and connect buyers. Hence, the output market for lotus products diversification is still available, yet accessibility on the output market and finding and connecting buyers are still issues of lotus growers.

"I have to go to Hue city to find out agencies, who can buy my products such as lotus flower or lotus leaf" a farmer in Phong Hien commune.

Knowledge about other lotus products: Effects and usage of lotus seed shelling, lotus leaf and lotus sprouts seem to be strange to many lotus growers. They do not use them or consider them as business products. Hence, these products have not explored yet as their potential.

"*Farmer cannot explore other parts of the lotus plant (except lotus seed), because they do not know the real value of these parts and processing technology. Lotus sprouts do not have buyers, they give to friends as a gift. Moreover, we do not know the value and how to use lotus peel, hence, it is used for fertilize*" local government of Phong Binh commune.

The traditional production habit and knowledge on lotus products diversification: producing and selling fresh unshelled lotus seed seem to become a habit of local farmers. Knowledge about products diversification, income diversification and adding product value are still strange to lotus growers. Otherwise, lotus growers mentioned that they can reduce risk and have time to make other jobs when they only sell raw products.

"*If we only sell fresh shelled lotus seed, we do not need thinking or worries on risks or losses. All of them are bought by collectors and we will get cash immediatly*" A farmer in Phong Hien commune

Impact of collectors: 100% lotus growers sell lotus products to collectors, who alway ensure to buy all the products at a suitable price. Although the transaction between lotus growers and collectors is made by informal transaction through verbal agreement, all transactions are always completed. There is a dependence of lotus growers on collectors when they do not have any alternative buyers. This situation is caused by the monopoly of collectors, and lotus growers do not tend to change these collectors. This relationship was conducted based on a long-term business relationship and both of them do not want to make a change in this relationship. Hence, decision-making of lotus growers in lotus products diversification is influenced by purchasing power of the collectors

From the barriers above, it clearly verifies that these barriers have been affecting the lotus products diversification of lotus growers; these barriers do not stay alone but they have relationship and interaction together. All lotus growers are struggling with these barriers while these barriers only deal with through the decision and investment of each farmer, as well as the support of external actors as local government, enterprises. Because, to achieve the motivation to make a diversification, lotus growers need to be proven the efficiency and real benefits that can support them to promote solution dealing with the barriers

Discussion and Conclusions

No room for doubt, the benefits of diversification in the agricultural sector have been proven in the aspects of income generating, risk reduction strategy, food security, stable food production, raising employment opportunities (Bachev & Tanic, 2011; Waha *et al.,* 2018). Therefore, crop diversification was applied by many countries in Europe, Asia or Africa that contributed to reaching sustainable development goals (Tamburini *et al.,* 2020). In fact, the determinants of crop diversification are differences between countries or crops, which involves the difference of barriers to diversification. Many researches had explored that the barriers to crop diversification come from internal factor such as capacity and characteristics of farmers (labour, finance, market access) (Bigsten & Tengstam, 2011; Ellis, 2000) and external factors as dynamic market, infrastructure, institutional environment, resource endowment (Bachev & Tanic, 2011).

Each crop has different characteristics in product and production and business activity, which lead to the difference in barriers. On the other hand, the difference among lotus growers from characteristics, capacity to decision-making can lead to the difference of barriers. Lotus farming in Phong Dien district, central Vietnam is a specific example. Diversification potential of lotus products has been verified when various parts of the lotus plant can produce various products. There are differences in price between lotus products such as

the price of fresh unshelled lotus seed is lower than the price of fresh shelled lotus seed. However, lotus products diversification of lotus growers in Phong Dien district is inconsistent with its potential. All lotus growers are mainly concentrating on producing and selling fresh unshelled lotus seed while less than 10% of lotus growers can diversify other products such as fresh shelled lotus seed, lotus flower, lotus leaf. In fact indicated that fresh shelled lotus seed, lotus flower, lotus leaf and lotus sprouts are completely produced by lotus growers; lotus products diversification can provide better profit; and lotus growers are willing to make changes in lotus product diversification. But, high profit and willingness is not enough while barriers to lotus products diversification are still available in lotus farming. These barriers are preventing the lotus products diversification at smallholders farmer level.

The research findings showed that lack of knowledge, worries on loss, lack of market and market information, lack of labour and machines and traditional production habit are main determinants of barriers to lotus products diversification. In which, lack of knowledge, worries on loss, lack of labour and traditional production habit can add in the group of internal factors from the research results of Bigsten & Tengstam (2011) and Ellis (2000); and, the rest of barriers including lack of market and market information and lack of machines belongs to external factors (Bachev & Tanic, 2011). Notably, the research of Waha *et al*. (2018) showed that diversification is viewed as a risk management strategy in agricultural production; but this study indicated that worries on loss and risks in lotus farming is a barrier to diversification. Rather, there are three new barriers that did not have in the list of barriers to crop diversification, which were verified by Morel *et al.* (2020). These barriers are viewed as typical barriers, which relate to characteristics of a specific crop and its products, as well as characteristics of lotus growers and territory. Specifically, lotus seed has to be processed immediately after harvesting; if lotus growers do not peel lotus seed, it will be hard to peel and lotus growers cannot sell them or sell them at low price. Lotus growers can diversify lotus products from fresh unshelled lotus seed to fresh shelled lotus seed when they have a small volume of lotus seed. Because lotus growers lack the labour and machine to implement the processing stage. It means that the more volume of lotus seed has, the more barriers to lotus products diversification. Hence, this barrier seems to be opposite to barriers to crop diversification ("*volumes are too limited in a given area to be profitably or easily collected*" (Morel *et al.,* 2020)). And, the monopoly of collectors in buying lotus products, which affects the decision-making of lotus growers. Because, the decision-making of lotus growers on what types of lotus products produce is depended the demand of collectors on types, quantity and quality of lotus products. Therefore, the diversification ability in crop production is still dependent on the characteristics of products and producers, as well as output markets of the products. From these points, barriers to diversification have the difference among crops.

Lotus farming in Phong Dien district plays an important role in socio-economic development at the locality and it is considered as a livelihood activity of local farmers, who are getting income from lotus products. Lotus farming area tends to increase, which also attracts the investment of local people and local government. Various lotus products are available on the market, but fresh unshelled lotus seed is still the main product in lotus farming of smallholder farmers. As a result, lotus products diversification potential, benefits of lotus products diversification, and willingness of lotus growers are existentialism. In which, fresh shelled lotus seed, fresh lotus flower, fresh lotus leaf and dry lotus sprouts are potential lotus products, which can be conducted by all lotus growers to improve and diversify income sources. But, the barriers to lotus products diversification are still happening and smallholder farmers have not overcome them. There is still a big gap between the demand and lotus products diversification ability of smallholder farmers. Hence, dealing with these barriers will open new directions for lotus growers in strengthening income, improving livelihood and sustainable development. These goals can be only achieved based on the self-investment of lotus growers in capacity building and infrastructure for lotus farming, as well as the intervention of the local government to support knowledge and capitals for local farmers.

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